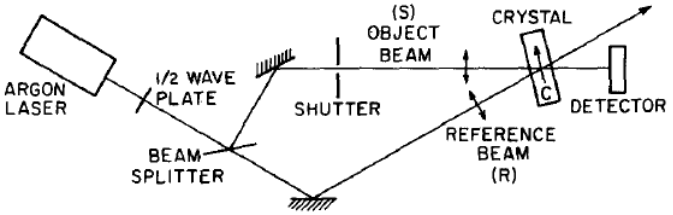
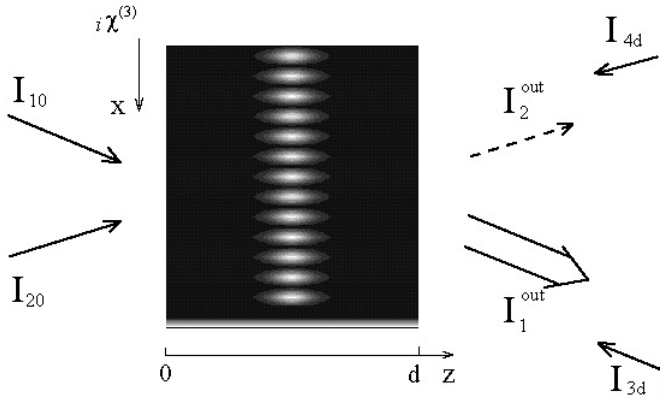
Nonlinear networks and the formation of dissipative solitons in problems of dynamic holography

Sveta Bugaychuk,
Labo PhLAM, Université et Lille,
Institute of Physics, Kyiv, Ukraine

Scheme of dynamic holography: **self-diffraction** of waves due to the creation of a **dynamic grating (DG)** by a light interference pattern.

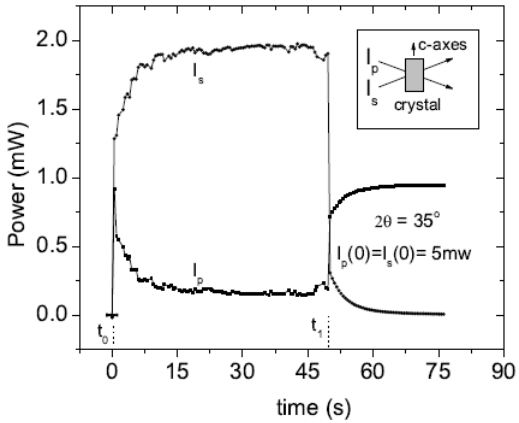


D.L.Staebler & J.J.Amodei, Coupled wave analysis of holographic storage in LiNbO3, J.Appl.Phys., 1972.

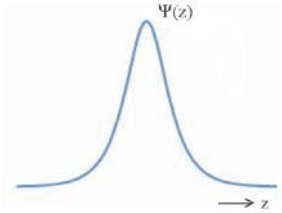


Spatial localization of the DG amplitude in the case of energy transfer.

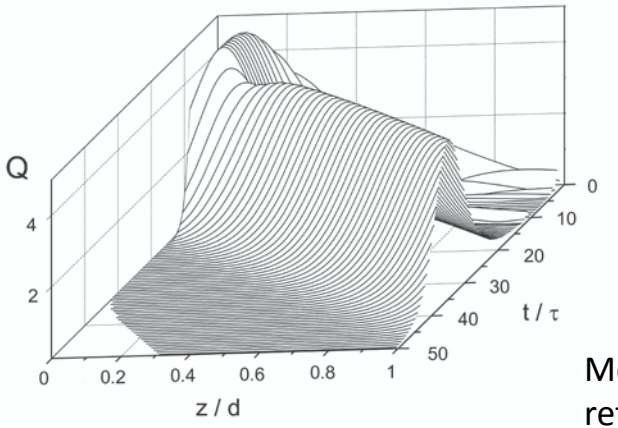
Experimental effect of **energy transfer** between two coherent interacting waves.



R.K.Banyal, Data storage and retrieval using photorefractive crystals (holographic memories), 2005.



Sech-function: stationary solution for the DG amplitude envelope.



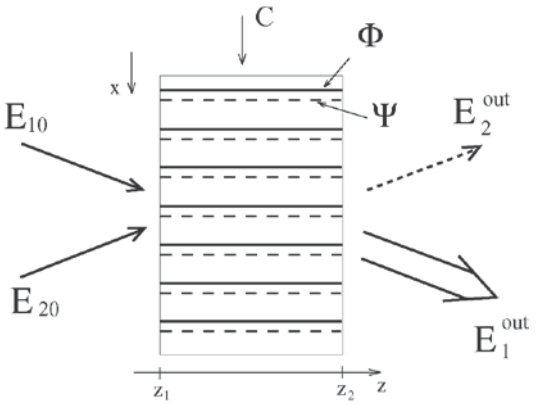
Movement of the DG amplitude envelope: retention of the soliton-like profile.

Equivalent system for
nonlinear interaction of two lattices.

$$\Psi_{tz} + \frac{1}{\tau}\Psi_z - \gamma\Phi_z = 0$$

$$\Phi_z = 2\Psi U$$

$$U_z = -[\Psi\Phi^* + \Psi^*\Phi]$$

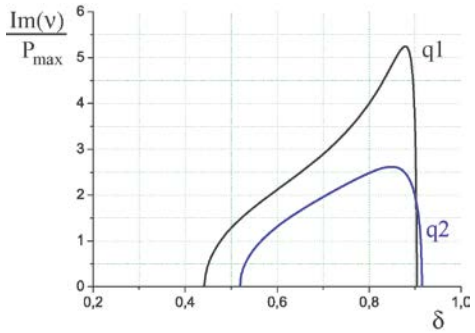


Modulation instability

$$\Psi = [A_0 + a(t,z)]e^{i(\Omega t - qz + \theta(t,z))}e^{-t/\tau}$$

$$\Phi = i[B_0 + b(t,z)]e^{i(\Omega t - qz + \vartheta(t,z))}e^{-t/\tau}$$

$$Im(\nu) = \gamma\frac{B_0}{A_0}\frac{\sqrt{-4\delta^6 + 4q^4\delta^2 - q^6}}{\delta(\delta^2 - q^2)}$$



Multi-scale analysis

Complex Ginzburg-Landau equation

$$iA_\eta + PA_{\varsigma\varsigma} + QA|A|^2 = RA$$

Nonlinear interaction of two lattices.
Formation of soliton profiles for
envelopes of amplitudes.